

**METHOD AND APPARATUS FOR MIXING MEAT PRODUCTS  
TO PRODUCE A pH ADJUSTED MEAT PRODUCT**

**INVENTOR:**

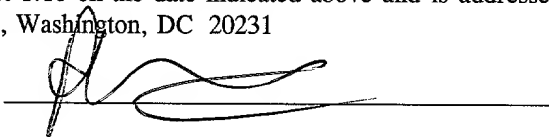
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1                   METHOD AND APPARATUS FOR MIXING MEAT PRODUCTS  
2                   TO PRODUCE A pH ADJUSTED MEAT PRODUCT  
3  
4

5                   TECHNICAL FIELD OF THE INVENTION

6           This invention relates to meat processing systems. More particularly, the invention  
7 relates to a method for mixing meat products to evenly distribute one meat product into another  
8 meat product to produce a final mixed product having an adjusted pH. The invention also  
9 includes an apparatus for mixing meat products.  
10

11                   BACKGROUND OF THE INVENTION

12           Adjusting the pH in a meat product may be desirable for several reasons. For example,  
13 modifying the pH of a meat product with ammonia has been shown to inhibit microbe growth  
14 in the treated meat product and to reduce live microbe count in the treated meat product.

15           A pH adjustment in a meat product may be produced by treating one meat product with  
16 a pH modifying material and then mixing that treated meat product with another meat product  
17 to produce a final product having a desired adjusted pH. When mixing two meat products  
18 together having two different pH characteristics, it is desirable to ensure that the two meat  
19 products are evenly distributed in the final product to produce a uniform pH in the final  
20 product. It is also desirable to produce this generally homogeneous pH without having to work  
21 the materials excessively. Working the meat products excessively may produce undesirable  
22 characteristics in the final mixed meat product.  
23

## SUMMARY OF THE INVENTION

It is an object of the invention to provide an improved method for mixing meat products, particularly two meat products having different pH levels. It is also an object of the invention to provide an apparatus for performing this improved mixing method.

The method according to the present invention includes forming an intermediate combination and then mixing the intermediate combination to produce the final mixed product.

The intermediate combination includes a first meat product having a first pH and a second meat product having a second pH. According to the invention, the first meat product in the intermediate combination comprises a plurality of pieces of the first meat product at a temperature below the freezing point of the first meat product. However, the second meat product in the intermediate combination is at a temperature at or above the freezing point of the second meat product. As the intermediate combination is mixed, the frozen pieces of the first meat product remain distinct and separate from the second meat product and thus become well distributed throughout the intermediate combination prior to thawing and commingling with the second meat product. The result of this mixing process is a more even distribution of the first meat product into the second meat product.

The pieces of the first meat product are preferably produced by forming a quantity of the first meat product into at least one elongated frozen strand of material. The frozen strand of first meat product may then be introduced into a mixer along with the second meat product. Introducing the frozen strand of material into the mixer along with operating the mixer

1 produces bending forces in the elongated strand of material and these bending forces cause the  
2 elongated strand to break into a plurality of small pieces.

3 The apparatus for performing the method according to the invention includes a mixer  
4 connected to receive the first meat product and the second product. The apparatus may include  
5 a forming arrangement comprising a first freezer, a grinder/extruder, and a second freezer.  
6 The first freezer places the first meat product in a desirable condition for the grinder/extruder  
7 to form at least one and preferably several elongated strands of the first meat product. The  
8 second freezer then receives the elongated strands and freezes the strands to a desired  
9 temperature. The apparatus also may include a pH modifying arrangement for receiving an  
10 initial meat product and producing the pH adjusted meat product for the forming arrangement.

11 As used in this disclosure and the accompanying claims the term "meat product" will be  
12 used to describe a comminuted product that includes animal flesh such as beef, pork, poultry,  
13 or fish. The term "meat product" is not intended to imply that the product is comprised  
14 entirely of animal muscle and other animal-derived materials such as animal fat. In particular,  
15 a "meat product" according to the invention may include non meat fillers, spices, and other  
16 materials which are not themselves meat products. Also, the "freezing point" of a meat  
17 product means the temperature at which ice crystals begin to form in the particular meat  
18 product at a given pressure. At any temperature below the freezing point of the meat product,  
19 the meat product will contain substantially all ice crystals and substantially no liquid water. At  
20 any temperature above the freezing point of the meat product, the meat product will contain  
21 substantially all liquid water and no ice crystals. Because the first and second meat products

1 used in the present mixing method may be different products, the freezing points of the two  
2 materials may be somewhat different.

3 In the preferred form of the invention the pieces of frozen first meat product in the  
4 intermediate combination are smaller than the pieces of the second meat product in the  
5 combination. This size relationship between the pieces of first and second meat product in the  
6 intermediate combination may be controlled with the grind size used for the meat products  
7 before they are introduced into the mixer. That is, the grind/extrusion size of the extruded  
8 first meat product is preferably smaller in diameter than the grind size of the second meat  
9 product.

10 The mixing method and mixing apparatus according to the invention produce a final  
11 mixed product having a pH that is different from both of the constituent meat products and  
12 preferably having a temperature different from the temperature of the constituent meat  
13 products. The mixture includes a substantially homogeneous pH and is formed without overly  
14 working the meat products.

15 The final mixed product produced according to the invention is preferably further  
16 processed through a final sizing device such as a grinder or bowl chopper. Final sizing may  
17 also be accomplished by heavy blending or by pumping or otherwise forcing the product  
18 through a conduit. This sizing device further mixes the final mixed product and ensures a  
19 desired size of the comminuted pieces making up the product.

1           These and other objects, advantages, and features of the invention will be apparent  
2           from the following description of the preferred embodiments, considered along with the  
3           accompanying drawings.

#### 5                           BRIEF DESCRIPTION OF THE DRAWINGS

6           Figure 1 is a diagrammatic representation of a mixing apparatus embodying the  
7           principles of the invention.

8           Figure 2 is a process flow chart showing the method steps performed according to the  
9           invention.

#### 11                          DESCRIPTION OF THE PREFERRED EMBODIMENTS

12           Referring to Figure 1, a mixing system 10 embodying the principles of the invention  
13           includes a forming arrangement shown generally at reference numeral 11 and a mixer 12.  
14           Forming arrangement 11 forms a first meat product into at least one frozen strand that readily  
15           breaks into a plurality of small pieces in mixer 12. Mixer 12 mixes an intermediate  
16           combination made up of the frozen pieces of the first meat product and a quantity of a second  
17           meat product. This second meat product in the intermediate combination in mixer 12 is at a  
18           temperature at or above the freezing point of the second meat product. The mixing action on  
19           the intermediate combination in mixer 12 results in a final mixed product having the first meat  
20           product evenly distributed through the second meat product.

1       The apparatus shown in Figure 1 is well suited for forming a final meat product having  
2       an adjusted pH. In this preferred application, the first meat product has a first pH which is  
3       different from the pH of the second meat product. The illustrated apparatus therefore includes  
4       pH modifying equipment 14 for producing the desired first meat product from an initial meat  
5       product received from an initial meat product supply 15. A second meat product supply 16  
6       directs the second meat product directly to mixer 12. It will be appreciated, however, that the  
7       particular arrangement shown in Figure 1 is shown only for purposes of providing an  
8       illustrative example. Other apparatus according to the invention may include a pH adjusting  
9       arrangement for adjusting the pH of the second meat product in addition to, or in lieu of, any  
10      pH modification to produce the first meat product.

11      Forming arrangement 11 in the apparatus shown in Figure 1 comprises a freezer 17  
12      which is preferably a roller press type freezer which freezes a comminuted meat product into a  
13      thin sheet and then cuts the sheet into small pieces. These small pieces of frozen comminuted  
14      meat product are then directed to a grinder 18 which extrudes the meat into at least one  
15      elongated strand of the first meat product. The elongated strands are then directed to a second  
16      freezer 19 which freezes the elongated strands. Freezer 19 may comprise any freezing device  
17      suitable for receiving the elongated strands of material and freezing that material in its  
18      elongated shape. For example, freezer 19 may comprise a tunnel freezer or belt freezer.

19      As mentioned briefly above, forming arrangement 11 shown in Figure 1 need not cut  
20      the elongated frozen strands prior to introduction into mixture 12. Rather, when a frozen  
21      strand of first meat product is introduced into mixer 12, and also as the mixer operates,

1 bending forces are applied to the frozen strand which cause the strand to break up into the  
2 desired small frozen pieces of material. Thus, in the form of the invention shown in Figure 1,  
3 the small pieces of frozen meat product are actually formed in mixer 12. It will be  
4 appreciated, however, that other forms of the invention could produce the small pieces prior to  
5 introduction into mixture 12. For example, the cutting arrangement associated with roller  
6 press freezer 17 shown in Figure 1 may cut the sheet of frozen first meat product exiting the  
7 drum of the roller press freezer into sufficiently small pieces for introduction into mixer 12. In  
8 this alternate form of the invention, grinder 18 and freezer 19 may be omitted.

9 Where the first meat product is formed into one or more frozen strands, the strands are  
10 preferably on the order of 1.5 inches or more in length as they enter mixer 12. Regardless of  
11 whether frozen strands are used, it is desirable for the small pieces of first meat product  
12 initially in the intermediate combination to be above a minimum size. In particular, it is  
13 desirable for the small pieces of frozen first meat product initially in the intermediate  
14 combination to have a minimum dimension no less than approximately one-sixteenth (1/16) of  
15 an inch.

16 The desired pH in the first meat product may be produced in any suitable fashion. For  
17 example, pH modifying equipment 14 shown in Figure 1 may comprise equipment for  
18 producing a meat product having a naturally higher or lower pH than the second meat product.  
19 For example, pH modifying equipment 14 may comprise equipment for producing Lean Finely  
20 Textured Beef which has a pH somewhat higher than regular ground beef. In this case, the  
21 second meat product may comprise regular ground beef. Alternatively, the pH of an initial



1 meat product may be altered by adding one or more pH modifying materials such as ammonia  
2 or carbon dioxide. Ammonia may be applied to increase the pH of a meat product, while  
3 carbon dioxide may be used to lower the pH of a meat product. In this alternate form of the  
4 invention, pH modifying equipment 14 may comprise a contactor for contacting ammonia with  
5 a comminuted initial meat product and then an additional comminuting device such as a grinder  
6 for grinding the ammoniated meat product to evenly distribute the ammonia through the  
7 material. This type of ammoniating apparatus is shown in U.S. Patent Application No.  
8 09/286,699, now U.S. Patent No. 5,871,795, the entire content of which is hereby  
9 incorporated herein by this reference. The pH modifying equipment 14 may alternatively  
10 comprise an apparatus such as that disclosed in U.S. Patent No. 6,142,067, the disclosure of  
11 which is also incorporated herein by this reference.

12 Mixer 12 may comprise any suitable mixing device suitable for mixing meat products.  
13 For example, mixer 12 may comprise a ribbon blender such as the device shown in U.S. Patent  
14 No. 4,733,607. Alternatively, mixer 12 may comprise a paddle type blender which includes  
15 one or more paddles mounted in a blender vessel. The paddle or paddles in this type of  
16 blender are driven through the vessel to provide a mixing action.

17 One preferred form of the invention includes a final sizing device 20 adapted to receive  
18 the final mixed material removed or ejected from mixer 12. This final sizing device 20 may  
19 comprise a grinder or a bowl chopper for example. Final sizing device 20 ensures the product  
20 contains comminuted pieces of the desired size and also serves as a quick final mixer.

1           The mixing method according to the invention may be described with reference to  
2     Figure 2. The method primarily comprises the steps of providing a first meat product as  
3     shown at block 30, providing a second meat product as shown at block 31, and then forming  
4     an intermediate combination with the first and second meat products as shown at block 32.  
5     The intermediate combination comprises a plurality of frozen pieces of the first meat product  
6     along with a quantity of the second meat product which is at a temperature at or above its  
7     freezing point, and more preferably above its freezing point. The basic method then includes  
8     mixing the intermediate combination as shown at block 33. This mixing step is preferably  
9     performed for a period of time sufficient for all of the frozen first meat product to rise to a  
10    temperature above the first meat product freezing point. This mixing time will depend  
11    primarily upon the respective temperatures of the first and second meat products.

12           In the preferred form of the invention, providing the first meat product includes  
13    providing an initial meat product as indicated at block 36 in Figure 2, and then adjusting the  
14    pH of the initial meat product as shown at block 37. The pH adjustment step may comprise a  
15    process such as forming Lean Finely Textured Beef. Alternatively, pH adjusting step 37 may  
16    comprise a process in which a pH modifying material such as ammonia is added to a meat  
17    product to increase the pH the initial product, or a process in which a pH reducing material  
18    such as carbon dioxide is added to the initial meat product. In either case, the pH modifying  
19    material may be added to the initial meat product and then the material may be further  
20    comminuted to distribute the pH modifying material evenly to produce the desired pH in the  
21    product.

1           The step of forming the intermediate combination shown at block 32 includes a series  
2 of individual steps needed to produce the plurality of frozen pieces of the first meat product.  
3 Although there are many different ways to produce the desired small frozen pieces of the first  
4 meat product, the preferred forming method includes freezing the pH adjusted first meat  
5 product as shown at block 40 in Figure 2 and then placing the resulting frozen first meat  
6 product in a condition for processing through a grinder/extruder such as device 18 shown in  
7 Figure 1. The pH adjusted meat product is then ground and extruded as shown at block 41 to  
8 form at least one elongated strand of the first meat product. This preferred grind/extrusion  
9 step takes the first meat product from a temperature below its freezing point and preferably  
10 approximately zero degrees Fahrenheit to a temperature near its freezing point at the outlet of  
11 the grinder/extruder. This grinder outlet temperature may be approximately 23 to 28 degrees  
12 Fahrenheit. As shown at process block 42 the method then includes freezing the elongated  
13 strand or strands of extruded material to a lower temperature preferably no greater than 20  
14 degrees Fahrenheit (and more preferably around zero degrees Fahrenheit), and then  
15 introducing the strand or strands into the mixer (12 in Figure 1) along with the quantity of  
16 unfrozen second meat product as shown at block 43. The temperature of the second meat  
17 product in the intermediate combination may be approximately 33 to 42 degrees Fahrenheit for  
18 example. Bending forces applied to the frozen strand or strands as upon introduction into the  
19 mixer and the further bending forces applied during mixing cause the strands to break up into  
20 the desired plurality of small frozen pieces of first meat product.

1           The individual pieces of frozen first meat product in the intermediate combination are  
2 preferably smaller in cross section than the comminuted material comprising the second meat  
3 product. For example, the grinder (18 in Figure 1) used to produce the strands in step 41 may  
4 produce strands approximately one-quarter inch in diameter while the second meat product in  
5 the intermediate combination may be at three-eighths inch in diameter or larger.

6           Mixing the intermediate combination as shown at process block 33 causes the frozen  
7 pieces of first meat product to become evenly distributed throughout the intermediate  
8 combination. Then, as the frozen pieces begin to thaw, the first meat product commingles with  
9 the second meat product to form a final mixed product. This final mixed product comprises a  
10 mixture of the first and second meat products having a substantially uniform pH different from  
11 both the pH of the first meat product and the pH of the second meat product, and having a  
12 temperature higher than the temperature of the frozen first meat product introduced into the  
13 mixer, but usually lower than the temperature of the second meat product introduced into the  
14 mixer. The temperature of the final mixed meat product may be approximately 33 degrees  
15 Fahrenheit for example. This material is removed from the mixer as shown at process block  
16 45 for final sizing as necessary and then packaging or further processing.

17           Final sizing may be performed in a device such as device 20 in Figure 1, comprising a  
18 grinder, bowl chopper, or similar comminuting device. This device not only ensures a proper  
19 grind size for the final mixed product but also performs a rapid final mix of the material  
20 without overly working the material.

1           The above described preferred embodiments are intended to illustrate the principles of  
2           the invention, but not to limit the scope of the invention. Various other embodiments and  
3           modifications to these preferred embodiments may be made by those skilled in the art without  
4           departing from the scope of the following claims.